REMARKS

The title has been amended as requested by the Examiner. Applicants respectfully submit that this change does not affect the scope of the claims.

Claim 1 has been amended to use the word "comprising" instead of "with." Applicants respectfully submit that this does not narrow the claim, but instead broadens it. This change is not in response to any rejection.

Claim 1 has been further amended to improve its paragraph structure. Applicants respectfully submit that this change does not change the scope of the claim and is not in response to any rejection.

Art rejections

The art rejections are respectfully traversed.

The references are complex – and moreover are from a different field from the invention. The invention came out of the field of gas discharge lamps, which is not mentioned in the references. Applicants will accordingly confine their remarks to those portions of the references cited by the Examiner, except as otherwise indicated. Applicants make no representation as to the contents of other portions of the references.

Any of the Examiner's rejections and/or points of argument that are not addressed below would appear to be moot in view of the following. Nevertheless, Applicants reserve the right to respond to those rejections and arguments and to advance additional arguments at a later date. No arguments are waived and none of the Examiner's statements are conceded.

REMARKS

Brown/Bachman combination (all independent claims)

Applicants respectfully submit that it is not obvious to combine the two references cited. The one, Brown, relates to lasers. The other, Bachman, comes out of the field of x-ray tubes. One of ordinary skill in the art would not assume that a foil suitable in an x-ray tube environment would satisfy the pressure stability requirements of a light source. The x-ray tube has a liquid metal target, rather than a gas discharge vessel as would be found in a light source. Therefore there is a much lower pressure requirement for an x-ray tube. Moreover the energy levels of the electron beams used in an x-ray tube are much higher than the energy levels used in a light source. Therefore it is not clear from Bachmann that its foil would work in a light source.

Accordingly, Applicants respectfully submit that it would not be obvious to use a window material from an x-ray tube in a light source, and that the motivation to do so comes from impermissible hindsight in light of Applicants' disclosure.

New claim 11 adds limitations relating to the field of gas discharge lamps, and particularly that the light produced is non-coherent. It is not obvious to take technology from the field of lasers and import it into the field of gas discharge lamps. Claim 11 therefore distinguishes even more clearly over the references than claim 1.

Similarly, new claim 12 restricts to the field of gas discharge lamps and therefore distinguishes even more clearly over the references than the older claims.

Claim 4: Brazing

The Examiner purports to find brazing in item 38 of Brown. Applicants respectfully submit that the Examiner mischaracterizes the reference. The Examiner appears not to appreciate the definition of brazing. Accordingly a definition from Wikipedia is appended

hereto. What Applicants are seeing in the cited portion of Brown is a foil that is screwed or bolted to a grill. Applicants see no teaching or suggestion of brazing here.

Claim 5: organic adhesion layer

The Examiner cites the very same portions of Brown for the recited organic adhesion as he cited for the brazing. Applicants respectfully submit that in fact Brown shows neither, at least in the portion cited by the Examiner. Screws & bolts are not an organic adhesion layer.

Claims 6 & 7

These claims recite details of the electron beam source (thermionic, field emitter). The Examiner purports to find this in items 18 and 20 of Bachman. Applicants are just not finding this in the reference, nor in fact any indication of what type of electron gun is used in this reference. Clarification is respectfully requested.

Claim 8

This claim recites that carbon atoms are deposited on a substrate so as to form a diamond foil. A portion of the substrate is etched away such that a remaining portion of the substrate forms a frame for the diamond foil.

The Examiner purports to find this in Brown. Applicants respectfully submit that the Examiner mischaracterizes Brown. The Examiner cites col. 7, lines 41-48; however, while this section of Brown does mention a foil, no method of manufacturing the foil is set forth. The Examiner states that item (38) is the frame which is recited as being etched away in the claim. Applicants respectfully disagree. The reference states that item 38 is a hibachi grill like grating

to which the film is screwed or bolted. This fails to teach or suggest the etching & and layer recited by the claim.

The Examiner merely cites Bachman for a diamond foil. The Examiner has not stated where Bachman teaches or suggests the claimed manufacturing method for the foil.

Applicant accordingly respectfully submits that the Examiner has failed to make a *prima facie* case against claim 8.

Claim 9

This claim recites:

- carbon atoms are deposited on a substrate so as to form a diamond foil (8),
- the diamond foil (8) is removed from the substrate, and
- the diamond foil (8) is brazed to a frame (7).

The Examiner purports to find these teachings in Brown's col. 7, lines 41-48. Applicants respectfully submit that the Examiner again mischaracterizes the reference. The reference appears to recite a foil, but not how it is formed, nothing about deposition of a layer, or removing a layer.

The Examiner further states that the foil is brazed to the frame (38). In this case, the Examiner is reading two distinct elements in the claim: substrate and frame, on the same single item in the reference, namely the hibachi grill like grating (38). Applicants respectfully submit that reading two distinct elements of the claim on a single element of the reference is improper.

Moreover, as stated before Applicants understand this portion of the reference to state that the foil is to be screwed or bolted to the grating, not brazed.

REMARKS

The Examiner merely cites Bachman for a diamond foil. The Examiner has not stated where Bachman teaches or suggests the claimed manufacturing method for the foil.

Applicants accordingly respectfully submit that the Examiner has failed to make a *prima facie* case against claim 9.

Claim 10

This claim recites

- carbon atoms are deposited on a substrate so as to form a diamond foil (8),
- the diamond foil (8) is removed from the substrate (7), and
- the diamond foil (8) is adhered to a frame (7).

The Examiner again purports to find this in the same portion of Brown. As stated before, this portion of Brown does not teach or suggest a manufacturing method for the foil – and, again, the cited portions of Bachman only appear to relate to a diamond foil not how that foil might be manufactured. A casual perusal of Bachmann does not lead the undersigned to anything about forming the foil using a substrate that is removed.

Applicants respectfully submit that in this rejection the Examiner again mischaracterizes Brown.

REMARKS

Please charge any fees other than the issue fee to deposit account 14-1270. Please credit any overpayments to the same account.

Applicants respectfully submit that they have addressed each issue raised by the Examiner — except for any that were skipped as moot — and that the application is accordingly in condition for allowance. Allowance is therefore respectfully requested.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited this date with the United States Postal Service as first class mail in an envelope addressed to

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Respectfully submitted,

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APPENDIX

Brazing

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For the cooking technique, see braising.

Brazing is a joining process whereby a non-ferrous filler metal and an alloy are heated to melting temperature (above 450°C; 800°F) and distributed between two or more close-fitting parts by capillary action. At its liquid temperature, the molten filler metal interacts with a thin layer of the base metal, cooling to form an exceptionally strong, sealed joint due to grain structure interaction. The brazed joint becomes a sandwich of different layers, each metallurgically linked to each other. Common brazements are about 1/3 as strong as the materials they join, because the metals partially dissolve each other at the interface, and usually the grain structure and joint alloy is uncontrolled. To create high-strength brazes, sometimes a brazement can be annealed, or cooled at a controlled rate, so that the joint's grain structure and alloying is controlled.

If silver alloy is used, brazing can be referred to as 'silver brazing'. Colloquially, the inaccurate terms "silver soldering" or "hard soldering" are used, to distinguish from the process of low temperature soldering that is done with solder having a melting point below 450 °C (800 °F). Silver brazing is similar to soldering but higher temperatures are used and the filler metal has a significantly different composition and higher melting point than solder. Likewise, silver brazing often requires the prior machining of parts to be joined to very close tolerances prior to joining them, to establish a joint gap distance of a few mils (thousandths of an inch) for proper capillary action during joining of parts, whereas soldering does not require gap distances that are anywhere near this small for successful joining of parts. Silver brazing works especially well for joining tubular thick-walled steel pipes, provided the proper machining is done prior to joining the steel parts.

In Braze Welding or Fillet Brazing, a bead of filler material reinforces the joint. A braze-welded tee joint is shown here.

In another common specific similar usage, *brazing* is the use of a bronze or brass filler rod coated with flux, together with an oxyacetylene torch, to join pieces of steel. The American Welding Society prefers to use the term **Braze Welding** for this process, as capillary attraction is not involved, unlike the prior silver brazing example. Braze welding takes place at the melting temperature of the filler (e.g., 1600 °F to 1800 °F or 870 °C to 980 °C for bronze alloys) which is

often considerably lower than the melting point of the base material (e.g., 2900 °F (1600 °C) for mild steel).

A variety of alloys of metals, including silver, tin, zinc, copper and others are used as filler for brazing processes. There are specific brazing alloys and fluxes recommended, depending on which metals are to be joined. Metals such as aluminum can be brazed though aluminum requires more skill and special fluxes. It conducts heat much better than steel and is more prone to oxidation. Some metals, such as titanium cannot be brazed because they are insoluble with other metals, or have an oxide layer that forms too quickly at intersoluble temperatures.

Although there is a popular belief that brazing is an inferior substitute for welding, it has advantages in many situations. For example, brazing brass has a strength and hardness near that of mild steel, and is much more corrosion-resistant. In some applications, brazing is highly preferred. For example, silver brazing is the customary method of joining high-reliability, controlled-strength corrosion-resistant piping such as a nuclear submarine's seawater coolant pipes. Silver brazed parts can also be precisely machined after joining, to hide the presence of the joint to all but the most discerning observers, whereas it is nearly impossible to machine welds having any residual slag present and still hide joints.

In order to work properly, parts must be closely fitted and the base metals must be exceptionally clean and free of oxides for achieving the highest strengths for brazed joints. For capillary action to be effective, joint clearances of 0.002 to 0.006 inch (50 to 150 µm) are recommended. In braze-welding, where a thick bead is deposited, tolerances may be relaxed to 0.020 inch (0.5 mm). Cleaning of surfaces can be done in several ways. Whichever way is selected, it is vitally important to remove all grease, oils, and paint. For custom jobs and part work, this can often be done with fine sand paper or steel wool. In pure brazing (not braze welding), it is vitally important to use sufficiently fine abrasive. Coarse abrasive can lead to deep scoring that interferes with capillary action and final bond strength. Residual particulates from sanding should be thoroughly cleaned from pieces. In assembly line work, a "pickling bath" is often used to dissolve oxides chemically. Dilute sulfuric acid is often used. Pickling is also often employed on metals like aluminum that are particularly prone to oxidation.

In most cases, flux is required to prevent oxides from forming while the metal is heated. The most common fluxes for bronze brazing are borax-based. The flux can be applied in a number of ways. It can be applied as a paste with a brush directly to the parts to be brazed. Commercial pastes can be purchased or made up from powder combined with water (or in some cases, alcohol). Alternatively, brazing rods can be heated and then dipped into dry flux powder to coat them in flux. Brazing rods can also be purchased with a coating of flux. In either case, the flux flows into the joint when the rod is applied to the heated joint. Using a special torch head, special flux powders can be blown onto the workpiece using the torch flame itself. Excess flux should be removed when the joint is completed. Flux left in the joint can lead to corrosion. During the brazing process, flux may char and adhere to the work piece. Often this is removed by quenching the still-hot workpiece in water (to loosen the flux scale), followed by wire brushing the remainder.

Brazing is different from welding, where even higher temperatures are used, the base material melts and the filler material (if used at all) has the same composition as the base material. Given

two joints with the same geometry, brazed joints are generally not as strong as welded joints. Careful matching of joint geometry to the forces acting on the joint, however, can often lead to very strong brazed joints. The butt joint is the weakest geometry for tensile forces. The lap joint is much stronger, as it resists through shearing action rather than tensile pull and its surface area is much larger. To get joints roughly equivalent to a weld, a general rule of thumb is to make the overlap equal to 3 times the thickness of the pieces of metal being joined.

The "welding" of cast iron is usually a brazing operation, with a filler rod made chiefly of nickel being used although true welding with cast iron rods is also available.

Vacuum brazing is another materials joining technique, one that offers extremely clean, superior, flux free braze joints while providing high integrity and strength. The process can be expensive because it is performed inside a vacuum chamber vessel however, the advantages are significant. For example, furnace operating temperatures, when using specialized vacuum vessels, can reach temperatures of 2400 °C. Other high temperature vacuum furnaces are available ranging from 1500 °C and up at a much lesser cost. Temperature uniformity is maintained on the work piece when heating in a vacuum, greatly reducing residual stresses because of slow heating and cooling cycles. This, in turn, can have a significant impact on the thermal and mechanical properties of the material, thus providing unique heat treatment capabilities. One such capability is heat treating or age hardening the work piece while performing a metal-joining process, all in a single furnace thermal cycle. See: M.J.Fletcher, “Vacuum Brazing”. Mills and Boon Limited: London, 1971.

[edit]

Advantages over welding

The lower temperature of brazing and brass-welding is less likely to distort the work piece, significantly change the crystaline structure (creating a Heat affected zone) or induce thermal stresses.

For example, when large iron castings crack, it is almost always impractical to repair them with welding. In order to weld cast-iron without recracking it from thermal stress, the work piece must be hot-soaked to 1600 °F. When a large (more than fifty kilograms (100 lb)) casting cracks in an industrial setting, heat-soaking it for welding is almost always impractical. Often the casting only needs to be watertight, or take mild mechanical stress. Brazing is the premium, preferred repair method in these cases.

The lower temperature associated with brazing vs. welding can increase joining speed and reduce fuel gas consumption.

Brazing can be easier for beginners to learn than welding.

APPENDIX

For thin workpieces (e.g., sheet metal or thin-walled pipe) brazing is less likely to result in burn-through.

Brazing can also be a cheap and effective technique for mass production. Components can be assembled with preformed plugs of filler material positioned at joints and then heated in a furnace or passed through heating stations on an assembly line. The heated filler then flows into the joints by capillary action.

Braze-welded joints generally have smooth attractive beads that do not require additional grinding or finishing. The most common filler materials are gold in colour, but fillers that more closely match the color of the base materials can be used if appearance is important.

[edit]